

have they all been rebuilt than it is necessary to recommence the reconstruction of the first; in this way the expenditure becomes perpetual. Therefore, their construction in the most durable manner is the best and most economical plan. For small culverts there is very little difference in the cost of timber and vitrified pipe; and culverts of five and ten feet span should be cement concrete arches. This work, if properly done, is permanent, and once done the expenditure should be over for a generation at least.

Municipal Statements and Records.

It is required by statute that every municipality issue, at the end of each year, a financial statement showing receipts and expenditures for the year. These statements serve an excellent purpose, one not to be in any way minimized. At the same time, consisting as they usually do of a mere list of the people to whom accounts were paid, they possess little value compared to that which might be given them, by showing, in addition, what works and services were accomplished with the expenditure, and what each cost in detail. If a statement of this latter kind is satisfactory, there is little need for criticism as to the people who were paid for doing the work or supplying material. While a statement showing to to whom money was paid will guard against favoritism on the part of the council, this is really a minor matter if the ratepayers have received full value for their money in labor or material, and if the money has been otherwise wisely expended.

It is not a difficult matter, at the close of every year, to go over the accounts, and classify them in accordance with the works to which they belong, especially if this has been kept in view throughout the year by the clerk of the municipality, who can, as each account is presented, see that the items are fully explained on the face of the account. By this means, a statement of the work performed during the year can be prepared. If it is a township municipality, each bridge or culvert constructed or repaired, can be specified together with the material required for each, and its cost; and the number of days labor and cost. The work done on each road can be specified, the number of days the grading machine was used on each particular job can be itemized, the amount of gravel and stone, with its cost, and the cost of hauling, etc., can be shown.

If it is a town, the same principle extends to streets, sidewalks, waterworks, sewers, electric light plants, etc. In the case of a waterworks system, the statement should show the cost of labor for the year, salaries paid, the amount and cost of coal used, of oil and waste, the repairs or extensions made, the amount of water pumped, and similar details which go to show the real cost of operation and the results produced.

It is statements of this kind which go to show, in a true light, success or failure in the management of a municipality's affairs,

not only so, but these records, in course of time, have an added value in showing what work has been done to certain culverts, bridges or roads; they indicate the comparative value of different materials used, or methods employed. They permit comparison with the results in other municipalities, and, in a more general way, show the relative value of the various systems which different municipalities may adopt. Their value in producing good municipal management is so great, and they can so easily be prepared, that to neglect doing so is very wrong on the part of municipal councils.

It is not a sufficient excuse that the municipality is small and the works of modest dimensions. In the care of such works, upon which little expenditure can be made, the need for economy is the more keenly felt, and such assistance as this record of experience will furnish should not be overlooked. Councillors, too, have not a perpetual lease of office, and details such as these statements supply, should, in justice to the municipality, be furnished to their successors. Certain local information, well known, perhaps, to the councillors of to-day, and apparently of little consequence at the present time, may very readily be lost to the council of ten years hence, and be productive of much expense and hindrance unless properly recorded. The neglect to provide plans of sewers, water-pipes, tile drains, and similar underground work, furnish one of the most frequent instances to be met with of oversight in this regard.

Pipe Sewers.

Pipe is ordinarily used for sewers up to eighteen or twenty-four inches diameter. Above this, up to forty-two inches, vitrified clay pipe is sometimes used, but many engineers are doubtful of the strength of the larger sizes against crushing. The smaller sizes, up to eighteen or twenty four inches, when made of good clay, well-burned, are sufficiently strong for ordinary locations, although the *double strength* pipe (having a thickness of shell one-twelfth the diameter,) is recommended rather than those of the standard thickness, which is less than one-twelfth the diameter. It has so far been found impracticable to make good, sound, symmetrical clay pipe with shells much thicker than one-twelfth the diameter. It is probable that if this thickness be maintained, the largest sizes of pipe are amply strong for ordinary circumstances.

In many instances where vitrified clay pipe has been crushed in the ground, it has been found that this was probably due to the fact that the pipe had a bearing on the bottom at only one or two points, instead of along its entire length, or that stones or frozen earth were thrown upon it when back-filling. If earth is well tamped under and around a vitrified clay pipe it will not usually collapse, even when broken, although it may leak. Such pipe ordinarily breaks along four lines, at top,

bottom and each side, into pieces of almost equal size. For this reason fire cracks and slight imperfections which do not cause the rejection of a pipe should be placed at a point about forty-five degrees above the horizontal in laying, and not at the top.

The joints of a vitrified clay pipe are generally made of the bell and spigot pattern, and in laying these are sealed with cement mortar.

A glazed clay pipe offers a poor surface for cement to adhere to, and consequently with it an absolutely tight joint is almost impossible of construction. After a short period of use, however, a well-made joint of good cement will become so stopped with matter strained from out-filtering sewage as to be practically water-tight. But if the head of ground-water is greater than that of sewage the flow will be inward and the joint will probably not become tighter than it was at construction. Tighter joints could be made if the glazing were omitted or removed from the surface in contact with the cement.

If much sewage leaks out through a joint, there is a danger that the remaining fluid will not be sufficient to keep the sewer clean of deposits. But, as just stated, such a condition seldom continues for a long time after the sewer is put into use if the joints are well made.

Since the joint is the weak place in a pipe, the fewer joints there are the better. The expense of laying, also, is decreased by lessening the number of joints. For these reasons the use of three-foot rather than two-foot lengths of pipe, is advised. Vitrified clay pipes, more than three feet long, have not, as yet, been manufactured with success, but three-foot lengths can be furnished by nine manufacturers at the same price per foot as the two-foot lengths. Some prefer to use the two-foot lengths when the diameter of the pipe exceeds fifteen or eighteen inches, as the three-foot lengths of the larger pipe would require a derrick for handling.

There are some advocates and users of cement sewer-pipe. It has the advantage over clay pipe that it can be moulded to exactly the size and shape desired, while the clay shrinks and sometimes warps in burning. It is, therefore, possible to obtain a sewer with a more uniform bore by using cement pipe; also to obtain the advantage, (not very considerable under most circumstances) of a flat base.

When this pipe is made of good cement and sand, and is properly proportioned and mixed, it should give a material which will improve with age. It is, however, more difficult to detect the quality of a cement than of a vitrified clay pipe, and much worthless cement pipe has consequently been put upon the market. Clay pipe has a smoother surface, but this difference grows less with age, owing to the coating which forms on each.

Cement pipe weighs from fifty to one hundred per cent. more than clay pipe of the same diameter.